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Attorneys for Plaintiffs SEOUL SEMICONDUCTOR CO., LTD., and SEOUL VIOSYS CO., LTD.

IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF NEW JERSEY

SEOUL SEMICONDUCTOR CO., LTD., a Korean corporation, and SEOUL VIOSYS CO., LTD., a Korean corporation,

Plaintiffs,

v.

ONYX ENTERPRISES INT'L CORP. d/b/a/ CARiD.COM

Defendant.

COMPLAINT FOR PATENT INFRINGEMENT

Civil Action No. _____

JURY TRIAL DEMANDED

Plaintiffs Seoul Semiconductor Co., Ltd. ("Seoul Semiconductor") and Seoul Viosys Co., Ltd. ("Seoul Viosys"), (collectively "Plaintiffs") for their Complaint against Defendant Onyx Enterprises Int'l Corp. d/b/a CARiD.COM ("CARiD") allege as follows:

INTRODUCTION

1. Plaintiffs bring this patent infringement action to protect their valuable patented technology relating to light-emitting diode (LEDs) and LED lighting. An LED is a semiconductor device that converts electrical energy into light. LEDs have many advantages over conventional light sources, including lower energy consumption, longer lifetime, and smaller size.

2. Seoul Semiconductor was founded in 1992 with around 30 employees in a small space of a commercial building in Bongchen-dong, Seoul. From those 30 employees, Seoul Semiconductor grew into one of the largest manufacturers of LEDs in the world. Seoul Viosys is also a leading company in the LED industry and an affiliate company of Seoul Semiconductor.

3. Seoul Semiconductor's success is in large part due to its significant investment in innovation and respect for intellectual property. Seoul Semiconductor has invested in research and development ("R&D") for the last two decades. Seoul Semiconductor invests over 10% of sales revenue into R&D and owns one of the largest LED patent portfolios in the world, which includes more than 10,000 patents worldwide.

THE PARTIES

4. Plaintiff Seoul Semiconductor is a company organized and existing under the laws of the Republic of Korea, with its principal place of business at 1B-25, 727, Wonsi-dong, Danwon-gu, Ansan-city, Gyeonggi-do, Korea 425-851.

5. Plaintiff Seoul Viosys is a company organized and existing under the laws of the Republic of Korea, with its principal place of business at 65-16, Sandan-ro 163 beon-gil, Danwon-gu, Ansan-city, Gyeonggi-do, Korea 425-851.

6. Upon information and belief, defendant Onyx Enterprises International Corporation is a company organized and existing under the laws of the State of New Jersey with its principal place of business located at 1 Corporate Drive, Cranbury, New Jersey 08512.

7. Upon information and belief, defendant Onyx Enterprises International Corporation does business as CARiD.

8. Upon information and belief, CARiD has a principal place of business located at 1 Corporate Drive, Cranbury, New Jersey 08512.

9. Upon information and belief, CARiD is in the business of offering for sale, selling and distributing automotive parts incorporating light-emitting diode (LED), including by online sales under the name CARiD.COM via the website www.carid.com.

10. CARiD sells LUMEN 9006HLC-G10, which is a fog light. Images of the LUMEN 9006HLC-G10 are provided below.

11. CARiD sells LUMEN 86-1001002, which is a daytime running light. Images of the LUMEN 86-1001002 are provided below.

JURISDICTION AND VENUE

12. This is an action for patent infringement, under the Patent Laws of the United States of America, 35 U.S.C. §271 *et seq.* This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

13. This Court has personal jurisdiction over CARiD as a resident of this District, due to CARiD's principal place of business being located in this judicial district. In addition, CARiD markets, distributes and/or sells infringing products throughout the United States, including to customers within this judicial district.

14. Venue is proper within this judicial district under 28 U.S.C. § 1400 because CARiD resides in this judicial district and/or CARiD has committed acts of infringement in this judicial district and has a regular and established place of business within this judicial district.

THE PATENTS IN SUIT

15. On October 8, 2019, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 10,439,105 ("the '105 Patent"), entitled "LIGHT EMITTING DIODE AND LIGHT EMITTING DIODE PACKAGE" to Chae *et al*. Seoul Viosys is the owner

by assignment of the '105 Patent. A true and correct copy of the '105 Patent is attached hereto as Exhibit 1.

16. On June 16, 2017, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,070,851 ("the '851 Patent"), entitled "WAFER-LEVEL LIGHT EMITTING DIODE PACKAGE AND METHOD OF FABRICATING THE SAME" to Seo *et al*. Seoul Semiconductor is the owner by assignment of the '851 Patent. A true and correct copy of the '851 Patent is attached hereto as Exhibit 2.

17. On December 13, 2016, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,520,543 ("the '543 Patent"), entitled "LIGHT-EMITTING DIODE MODULE HAVING LIGHT-EMITTING DIODE JOINED THROUGH SOLDER PASTE AND LIGHT-EMITTING DIODE" to Chae *et al*. Seoul Viosys is the owner by assignment of the '543 Patent. A true and correct copy of the '543 Patent is attached hereto as Exhibit 3.

18. On February 13, 2018, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,893,240 ("the '240 Patent"), entitled "LIGHT EMITTING DIODE AND LED MODULE HAVING THE SAME" to Chae *et al*. Seoul Viosys is the owner by assignment of the '240 Patent. A true and correct copy of the '240 Patent is attached hereto as Exhibit 4.

19. On November 28, 2017, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,831,401 ("the '401 Patent"), entitled "LIGHT EMITTING DIODE MODULE FOR SURFACE MOUNT TECHNOLOGY AND METHOD OF MANUFACTURING THE SAME" to Chae *et al*. Seoul Viosys is the owner by assignment of the '401 Patent. A true and correct copy of the '401 Patent is attached hereto as Exhibit 5.

20. On January 2, 2018, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,859,469 ("the '469 Patent"), entitled "LIGHT EMITTING DIODE FOR SURFACE MOUNT TECHNOLOGY, METHOD OF MANUFACTURING THE SAME, AND METHOD OF MANUFACTURING LIGHT EMITTING DIODE MODULE" to Chae *et al*. Seoul Viosys is the owner by assignment of the '469 Patent. A true and correct copy of the '469 Patent is attached hereto as Exhibit 6.

21. On June 2, 2015, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,048,409 ("the '409 Patent"), entitled "WAFER-LEVEL LIGHT EMITTING DIODE PACKAGE AND METHOD OF FABRICATING THE SAME" to Seo *et al*. Seoul Semiconductor is the owner by assignment of the '409 Patent. A true and correct copy of the '409 Patent is attached hereto as Exhibit 7.

22. On May 12, 2015, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,029,892 ("the '892 Patent"), entitled "DEVICE MODULE" to Sugizaki *et al*. Seoul Semiconductors is the owner by assignment of the '892 Patent. A true and correct copy of the '892 Patent is attached hereto as Exhibit 8.

23. On September 19, 2017, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,768,367 ("the '367 Patent"), entitled "LIGHT EMITTING DEVICE" to Chae *et al*. Seoul Viosys is the owner by assignment of the '367 Patent. A true and correct copy of the '367 Patent is attached hereto as Exhibit 9.

24. On July 19, 2011, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,982,207 ("the '207 Patent"), entitled "LIGHT EMITTING DIODE" to Kim *et al*. Seoul Viosys is the owner by assignment of the '207 Patent. A true and correct copy of the '207 Patent is attached hereto as Exhibit 10.

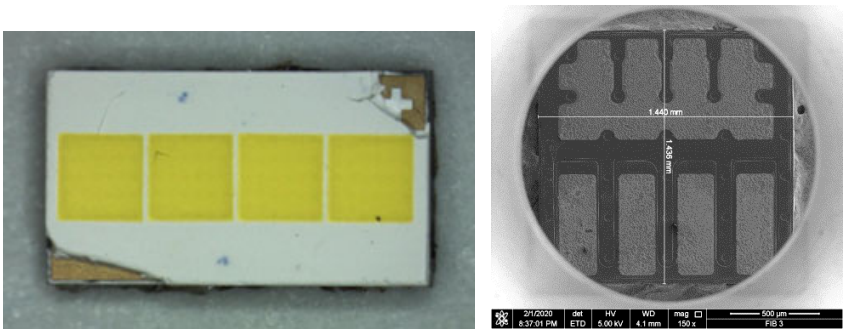
25. On September 13, 2005, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 6,942,731 ("the '731 Patent"), entitled "METHOD FOR IMPROVING THE EFFICIENCY OF EPITAXIALLY PRODUCED QUANTUM DOT SEMICONDUCTOR COMPONENTS" to Sellin *et al*. Seoul Semiconductor is the owner by assignment of the '731 Patent. A true and correct copy of the '731 Patent is attached hereto as Exhibit 11.

26. On February 23, 2016, by the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,269,868 ("the '868 Patent"), entitled "Semiconductor Light Emitting Element and Method for Manufacturing Semiconductor Light Emitting Element" to Kushibe *et al*. Seoul Semiconductor is the owner by assignment of the '868 Patent. A true and correct copy of the 868 Patent is attached hereto as Exhibit 12.

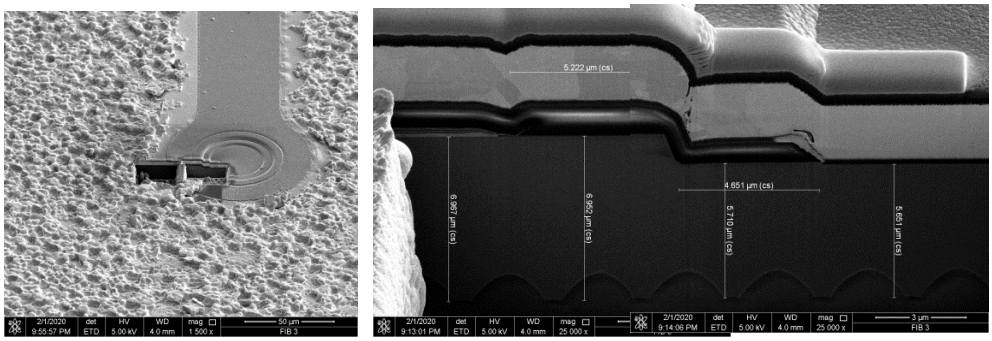
COUNT I
INFRINGEMENT OF THE '105 PATENT
EXAMPLE CLAIM 1

27. CARiD has infringed and continues to infringe one or more claims of the '105 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

28. The LUMEN 9006HLC-G10 includes a light emitting diode ("LED") package, which includes a light emitting diode chip. The image below (left) shows an LED package of the LUMEN 9006HLC-G10, which comprises a plurality of LED chips. The image below (right) shows a scanning electron microscope ("SEM") image of the bottom of one such LED chip.



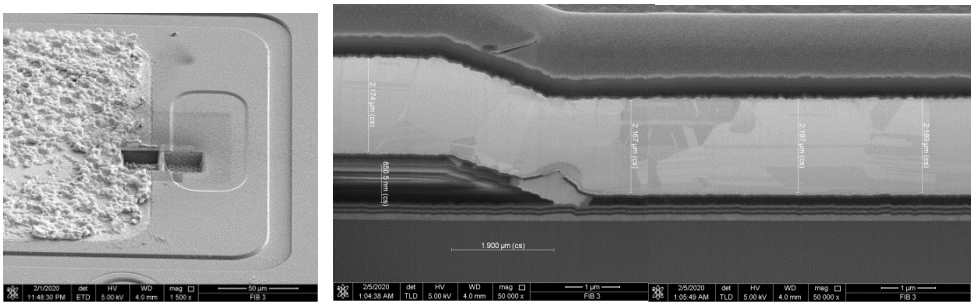
29. The SEM image below (left) shows a pair of holes milled into the bottom of the LED chip using a focused ion beam. The SEM image below (right) is a cross-sectional image created from scanning electron microscope images of the right milled hole. There is a first conductive type (n-type)semiconductor layer on the bottom, and on the left side there is a mesa disposed on top of this first conductive type semiconductor layer. The mesa is comprised of an active layer and a second conductive type (p-type) semiconductor layer. The image further shows a reflective electrode on top of the mesa, and a current spreading layer on top of the mesa. On the right side of the SEM image below right, part of the current spreading layer is in ohmic-contact with the first conductive type (n-type) semiconductor layer below it.



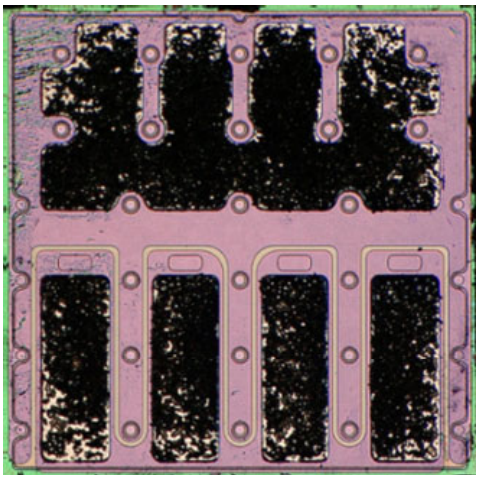
30. In the image above (right), there is also a lower insulating layer on the left that is above the mesa and reflective electrode, but below the current spreading layer. The lower insulating layer insulates the current spreading layer from the mesa and the reflective electrode.

31. The SEM image below (left) shows another pair of holes milled into the bottom of the LED chip using a focused ion beam. The SEM image below (right) shows a cross-section

created from scanning electron microscope images of the right milled hole. The image shows a darker-colored insulation layer on the left. The insulation layer rests on top of the reflective electrode disposed on the mesa and ends to create an opening that exposes the reflective electrode.

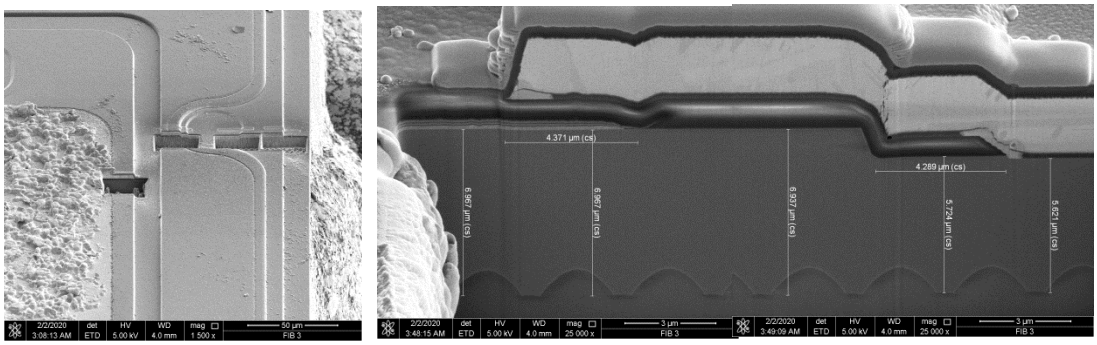


32. The image below shows the bottom of a LUMEN 9006HLC-G10 LED chip. The image shows the mesa discussed above disposed between a first n-contact region and a second n-contact region. More specifically, each of the circles in the image below provide contact to the underlying first conductive type (n-type) layer.

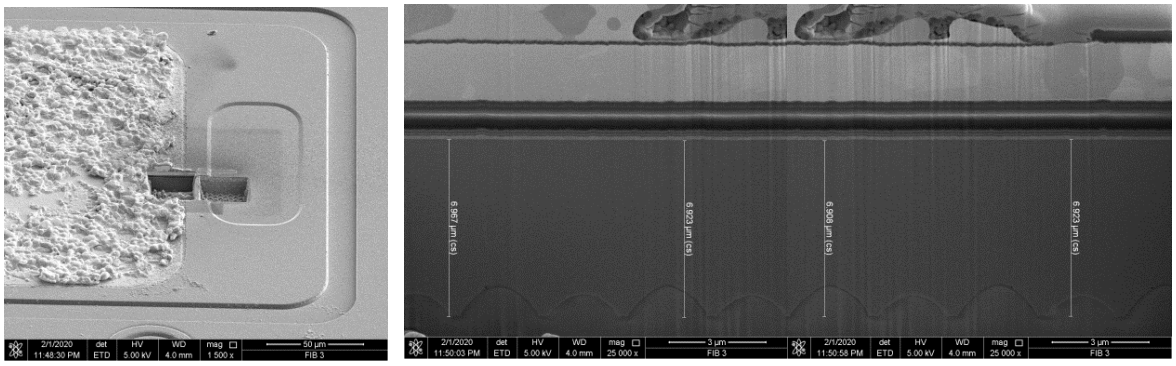


33. The SEM image below (left) shows additional holes milled into the bottom of the LED chip near the second n-contact region using a focused ion beam. The SEM image (right) below shows a cross-section created from scanning electron microscope images of the milled hole on the left side of the circular n-type contact. There is an opening on the right side of the image where the first conductive type (n-type) semiconductor layer is exposed. At the opening, the

lighter-colored current spreading layer is in ohmic contact with the darker colored first conductive type (n-type) semiconductor layer below it.



34. The SEM image below (left) once again shows the two holes milled into the bottom of the LED chip. The SEM image below (right) below shows a cross-section created from scanning electron microscope images of the left hole. As shown in this cross-section, there is a dark-colored upper insulating layer on the far right that covers a portion of the current spreading layer. The current spreading layer is disposed on an upper portion of the mesa described above. To the left of the upper insulating layer, there is a hole in the insulating layer exposing a second portion of the current spreading layer. The hole in the insulating layer is indicated by the uneven solder surface in the image below left.



35. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury

unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

36. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

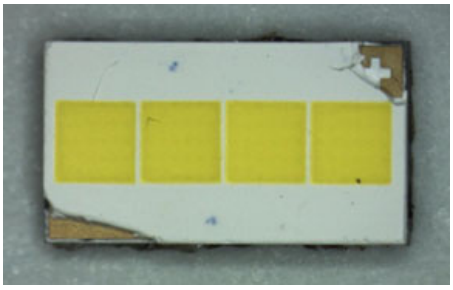
COUNT II

INFRINGEMENT OF THE '851 PATENT

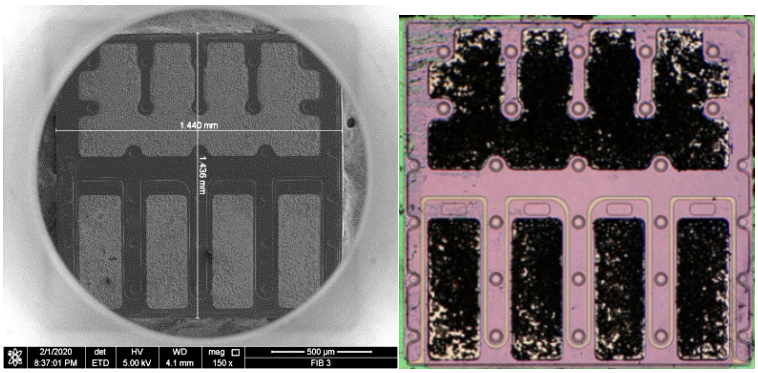
EXAMPLE CLAIM 1

37. CARiD has infringed and continues to infringe one or more claims of the '851 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

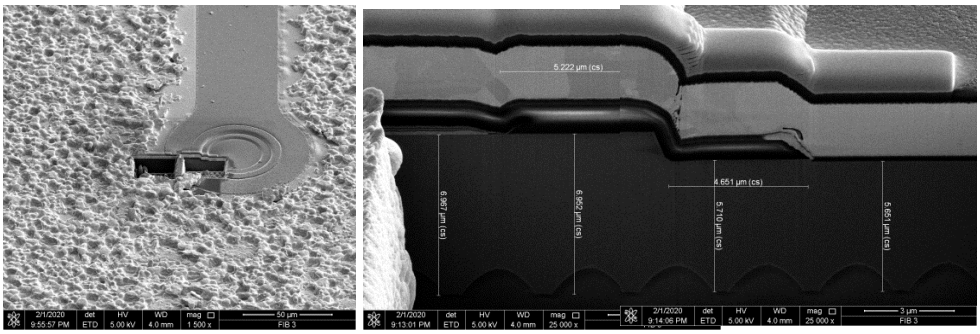
38. The image below shows the LED package of the LUMEN 9006HLC-G10, which comprises a plurality of LED chips.



39. The SEM image below (left) shows the bottom of one of the plurality of LED chips. The image below (right) provides an enlarged optical view of the bottom of the LED chip. As seen in the images, there are a plurality of contact holes on the LED chip.

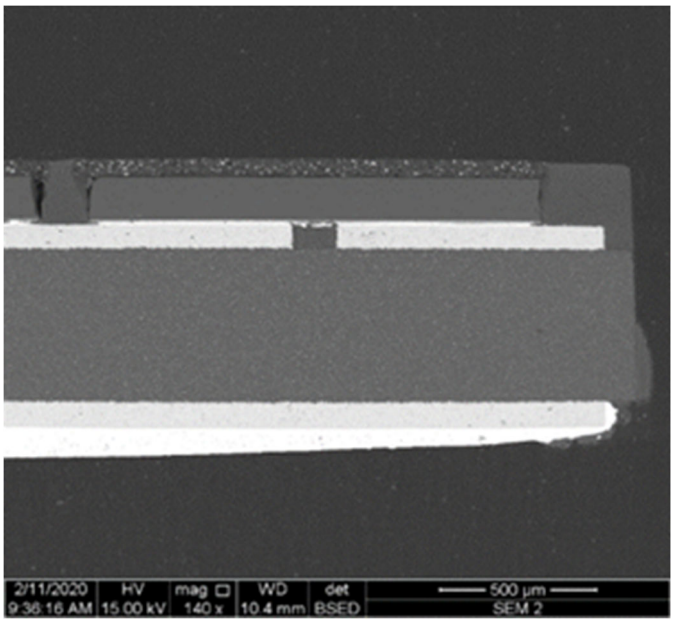


40. The SEM image below (left) is a further enlarged view of one of these contact holes. In the image, two holes have been milled into the LED chip using a focused ion beam. The SEM image below (right) shows a cross-section created from scanning electron microscope images of the right milled hole. The contact hole, at the far right, is surrounded by a mesa comprised of a second conductive type (p-type) semiconductor layer and an active layer such that the contact hole penetrates through the second conductive type (p-type) semiconductor layer and the active layer to expose the first conductive type (n-type) semiconductor layer below. The other contact holes similarly penetrate through the second conductive type (p-type) semiconductor layer and active layer to expose the first conductive type (n-type) semiconductor layer.

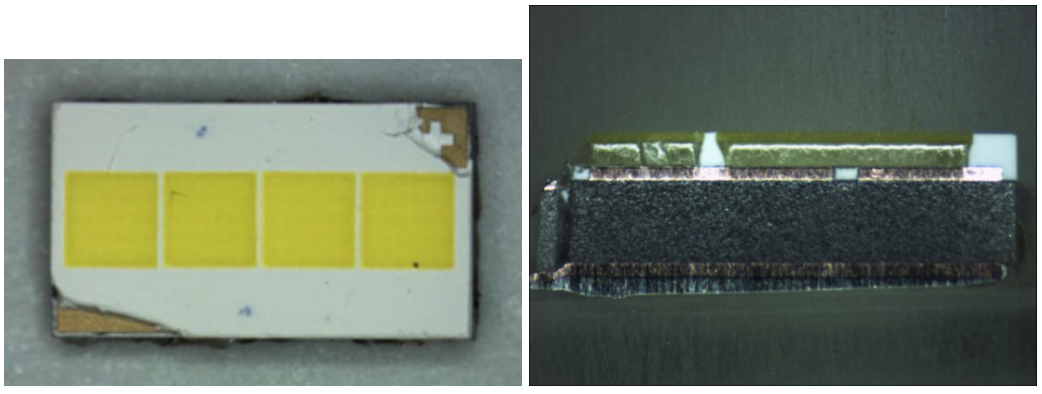


41. The SEM image below shows a cross-section through the printed circuit board and an LED chip of the LUMEN 9006HLC-G10. The cross-section shows bumps on the bottom of the chip where contact is made to the underlying electric leads. The bumps are respectively

electrically connected to the first conductivity type semiconductor layer via contact holes and to the second conductive semiconductor layer.



42. The image below (left) shows the package of the LUMEN 9006HLC-G10. The optical image below (right) shows a cross-sectional view of the package. As seen in the images, a protective insulation layer covers the external side walls surrounding the LED package such that the protective insulation layer surrounds the semiconductor stack.



43. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury

unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

44. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

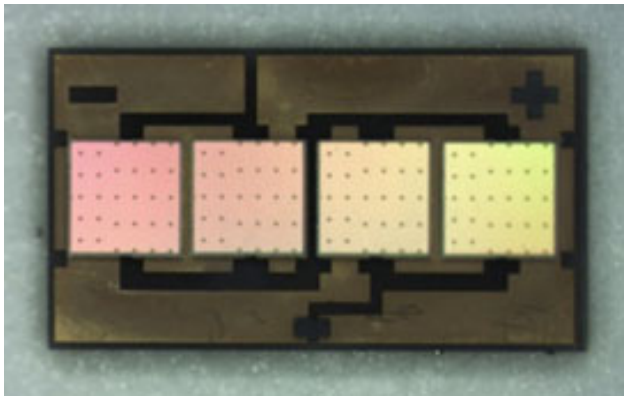
COUNT III

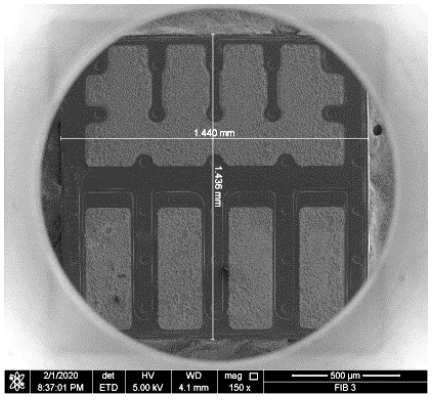
INFRINGEMENT OF THE '543 PATENT

EXAMPLE CLAIM 1

45. CARiD has infringed and continues to infringe one or more claims of the '543 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

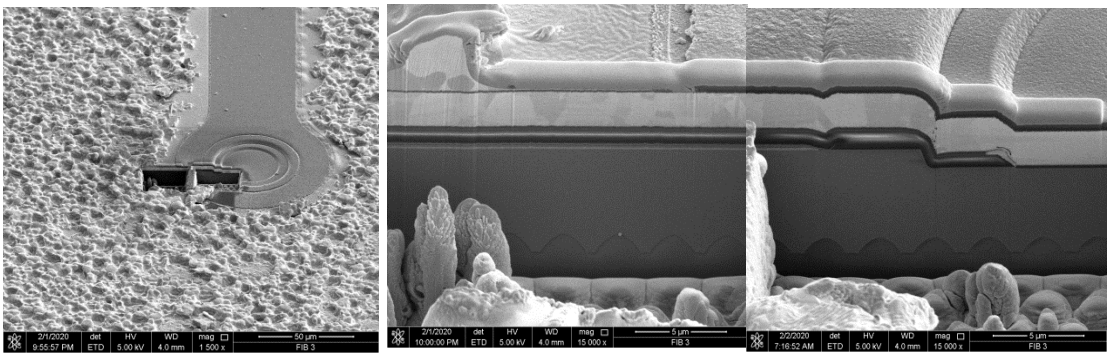
46. The image below (left) shows an LED package of the LUMEN 9006HLC-G10. As shown in the image, the package comprises a plurality of LED chips bonded to a printed circuit board. The image below (right) shows the back surface of an LED after removal from the package.





47. As discussed in Count I, the LED includes a first conductivity type semiconductor layer and a mesa disposed over the first conductivity type semiconductor layer, the mesa comprising an active layer and a second conductivity type semiconductor layer.

48. The SEM image below (left) shows an enlarged view of one of the contact holes from the bottom surface of one of the LED chips. In the image, two holes have been milled into the LED chip using a focused ion beam. The SEM image below (right) shows a cross-section created from scanning electron microscope images of the milled holes. The image shows a lighter-colored first electrode pad above and electrically connected to the darker colored-colored first conductive-type (n-type) semiconductor layer at the right edge of the image. Also shown in the image below right is a mesa to the left of the circular contact hole. More specifically, the mesa comprises the raised portion that begins to the left of the contact hole and extends to the far left side of the image. The mesa includes both an active layer and a second conductive-type (p-type) semiconductor layer.

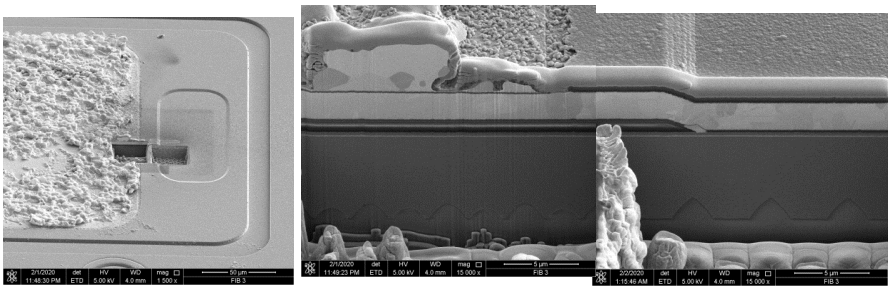


49. The image above right also shows a reflective electrode structure upon the mesa. The reflective electrode appears as a thin brightly colored atop the mesa that begins just to the right of center in the image and extends to the left edge of the image and is made of silver. In addition, just above the reflective electrode is at least one anti-diffusion reinforcing layer.

50. The image above left also shows an irregular pattern of bumps that indicates the location where solder was used to bond the chip to a negative pad on the printed circuit board.

51. The SEM image below (left) shows an enlarged view of another area on the bottom surface of the chip. In the image, two holes have been milled into the LED chip using a

focused ion beam. The SEM image below (right) shows a cross-section created from scanning electron microscope images of the milled holes. The cross-section indicates that the holes were cut into the mesa. The thin light layer on top of the mesa indicates a different portion of the reflective electrode.



52. The image above left also has a rounded rectangular depression near the center of the image. That depression, a portion of which is also depicted in the image above right, indicates the location where an electrical connection is made between the second electrode pad and the reflective electrode via the at least one anti-diffusion reinforcing layer.

53. The image above left also again shows an irregular pattern of bumps that indicates the location where solder was used to bond the chip to a positive pad on the printed circuit board.

54. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

55. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

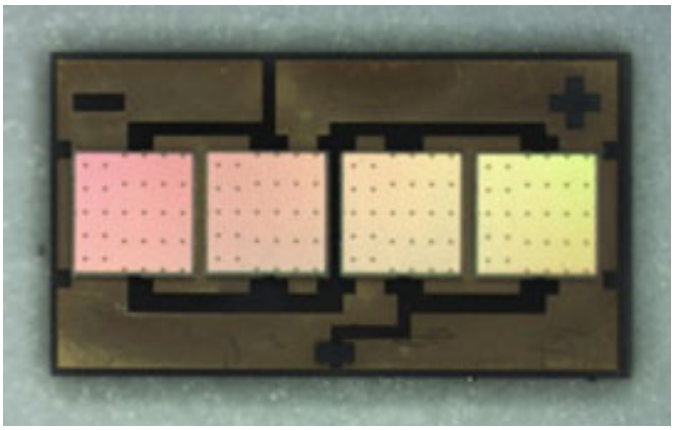
COUNT IV

INFRINGEMENT OF THE ’240 PATENT

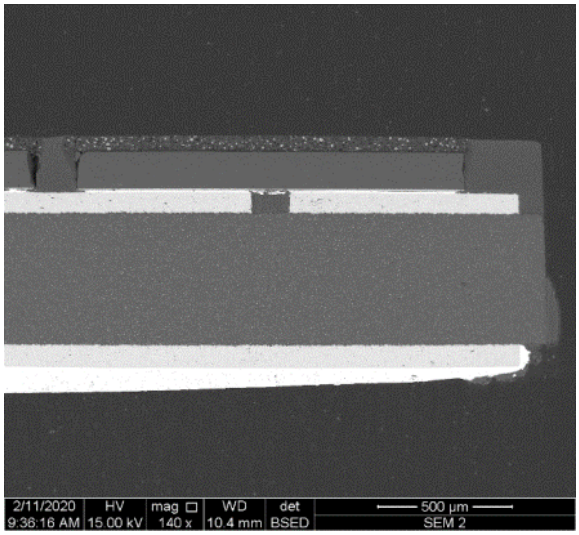
EXAMPLE CLAIM 1

56. CARiD has infringed and continues to infringe one or more claims of the ’240 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

57. The image below shows an LED package of the LUMEN 9006HLC-G10. As shown in the image, the package comprises a plurality of LED chips adhering to a printed circuit board.

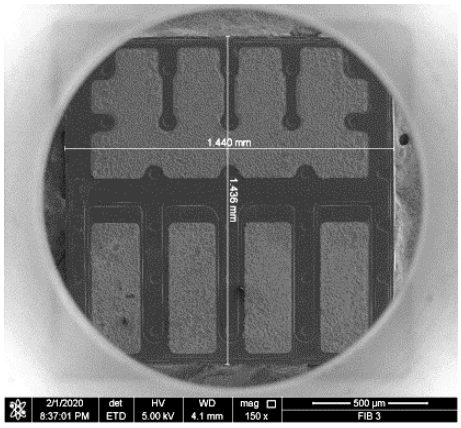


58. The SEM image below shows a cross-section through the printed circuit board and LED chip of the LUMEN 9006HLC-G10.

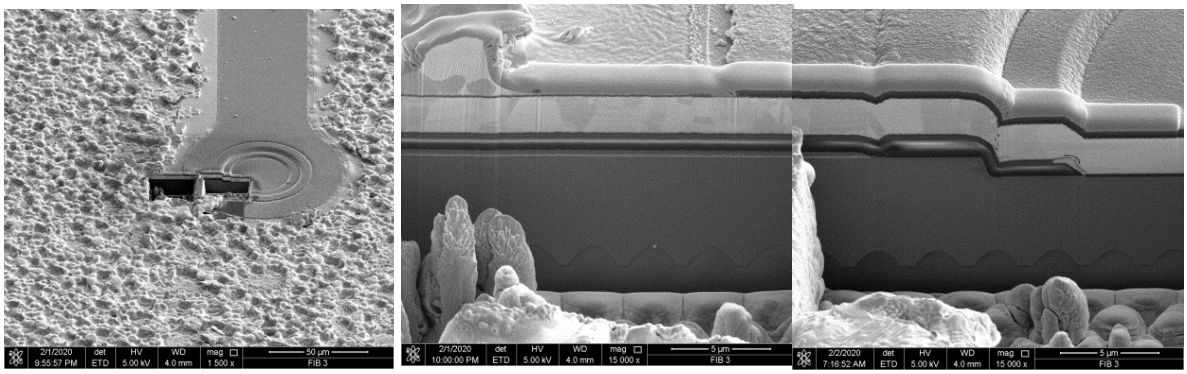


59. As discussed in Count I, the LED includes a first conductivity type (n-type) semiconductor layer and a mesa disposed over the first conductivity type semiconductor layer, the mesa comprising an active layer and a second conductivity type (p-type) semiconductor layer.

60. The SEM image below shows the bottom of an LED chip of the LUMEN 9006HLC-G10.

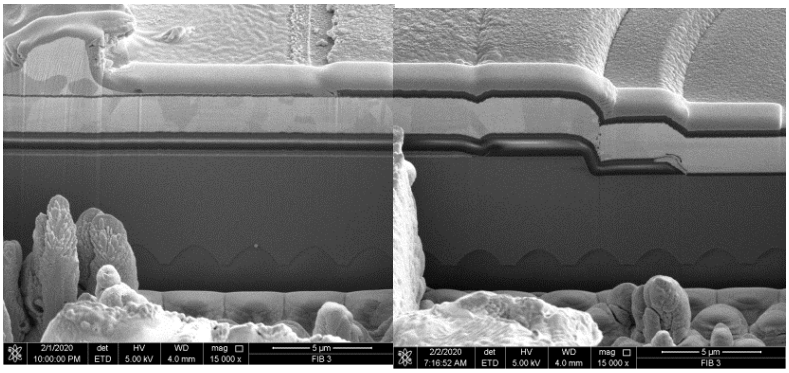


61. The SEM image below (left) shows an enlarged view of a first part of the bottom surface of the chip. In the image, two holes have been milled into the LED chip using a focused ion beam. The SEM image below (right) shows a cross-section created from scanning electron microscope images of the milled holes.

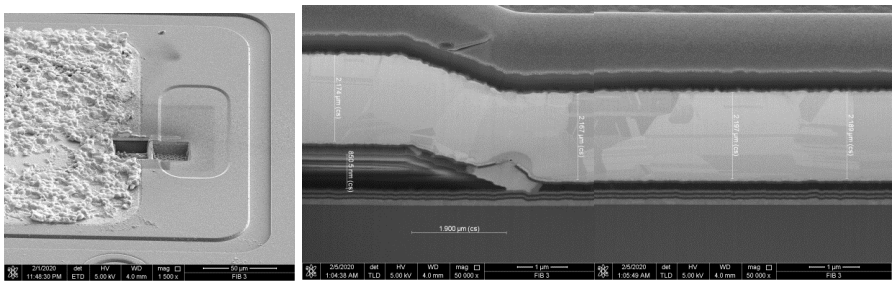


62. The left side of the image above (right) shows a mesa on top of the first conductivity type (n-type) semiconductor layer. The mesa includes a second conductivity type (p-type) semiconductor layer and an active layer. Along the top of the mesa is an ohmic-contact structure contact with the second conductivity type (p-type) semiconductor layer.

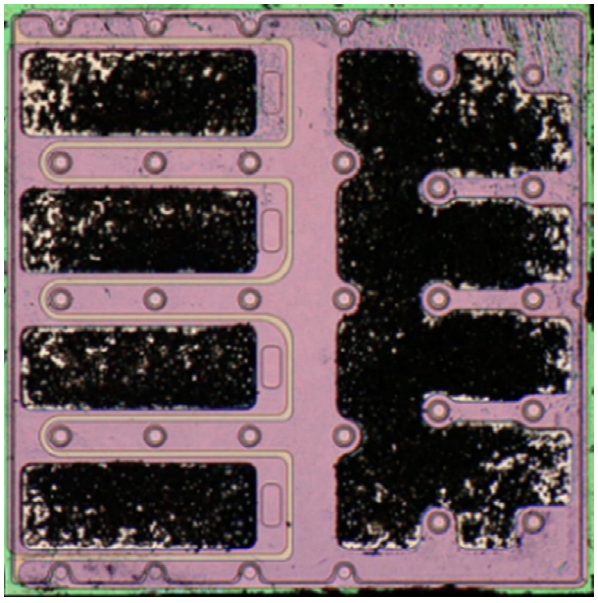
63. Above the ohmic-contact structure is a lower insulating layer comprised of silicon dioxide. As shown in the image below, the silicon dioxide lower insulating layer covers the top of the mesa and has an opening toward the right side of the image where the first conductivity type (n-type) semiconductor is exposed.



64. The SEM image below (left) shows an enlarged view of the area on the bottom surface of the chip where a second opening part is located. In the image, two holes have been milled into the LED chip using a focused ion beam. The SEM image below (right) shows a cross-section created from scanning electron microscope images of right hole.

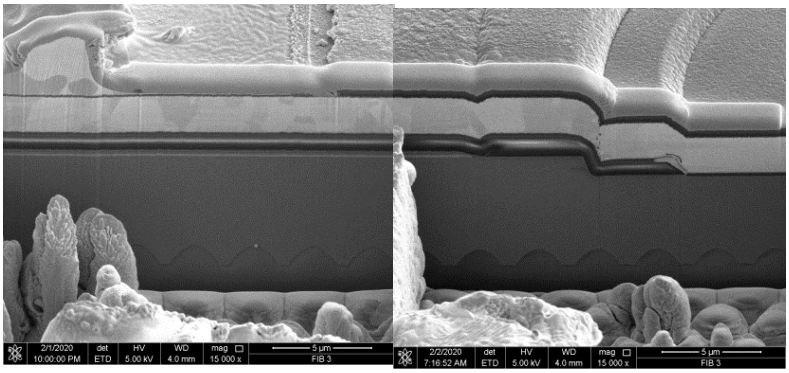


65. The second opening part can be seen in the image above (right) exposing the ohmic-contact structure, which itself is in contact with the second conductivity type (p-type) semiconductor. The image below is of the full bottom surface of the LED. The image shows four small rounded rectangles just to the left of center, any of which can comprise a second opening part for providing current to the second conductivity type (p-type) semiconductor. The small circles in the image below comprise parts of the first opening pattern for providing current to the first conductivity type (n-type) semiconductor. As the image shows, the second opening parts are disposed between portions of the first opening pattern at the top and bottom edges of the light emitting diode.

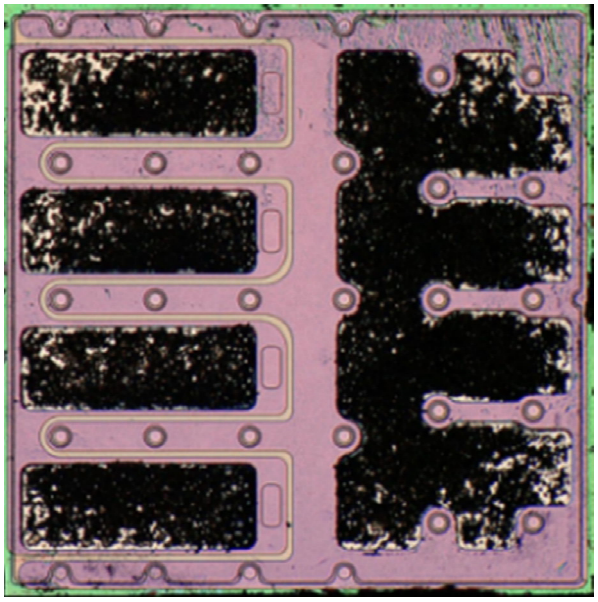


66. Returning to the cross-section image below, a current distributing layer is depicted as the relatively thick and lightly colored metal layer that is electrically isolated from the

mesa and electrically connected to the first conductivity type semiconductor layer at the far right edge of the image.

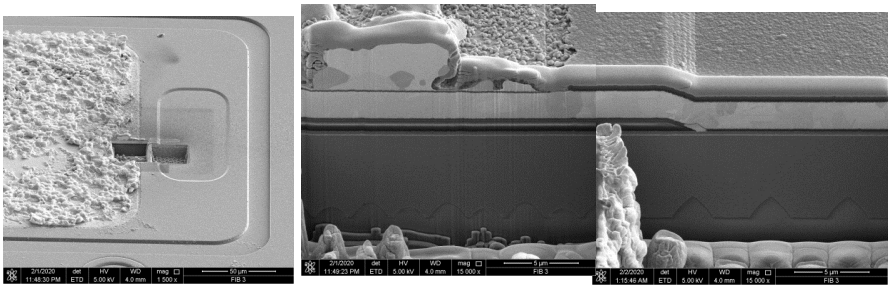


67. As shown in the image below, the small circles all comprise contacts to the first conductivity type (n-type) semiconductor layer. The current distributing layer connects those contacts together. The yellow line that crosses from the left edge toward the middle of the chip indicates the break in the current distributing layer, and thus defines a third opening part within which at least one second opening part is exposed.



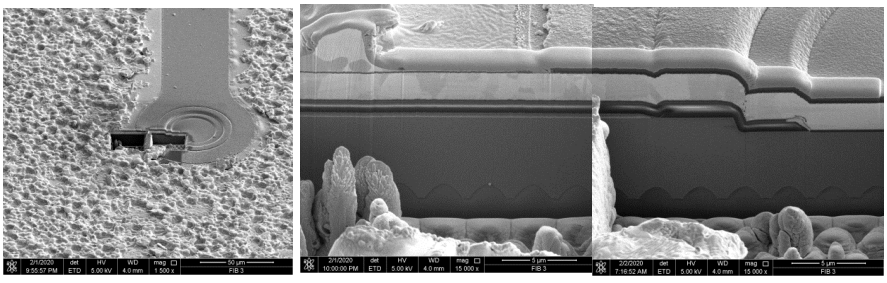
68. The SEM image below (left) shows an enlarged view near the second opening part. The two holes shown cut into the mesa of the LED chip within the third opening. The SEM

image below (right) shows a cross-section created from scanning electron microscope images of the milled holes.



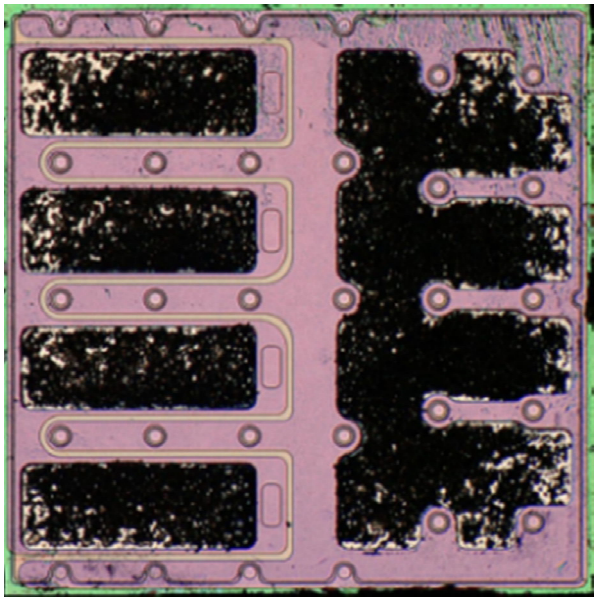
69. The SEM image above (right) shows an enlarged view of a portion of the mesa. Above the ohmic contact is at least one diffusion preventing, which exists within the third opening discussed above and also provides an electrical connection to the ohmic contact as indicated to the far right in the image above.

70. The SEM image below (left) once again shows an enlarged view of a part of the bottom surface of the chip. In the image, two holes have been milled into the LED chip using a focused ion beam. The SEM image below (right) once again shows a cross-section created from scanning electron microscope images of the milled holes. As seen in the right side of the image, a dark upper insulating layer is provided over a portion of the upper surface of the current distributing layer.

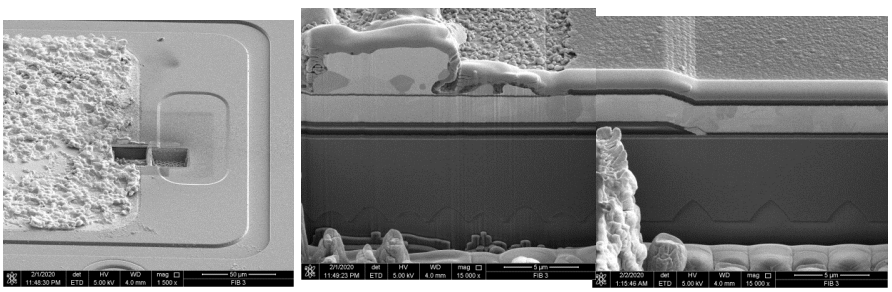


71. The upper insulating layer covers the current distributing layer except where the dark solder in shown on the right side of the image below, with the outline of the dark solder

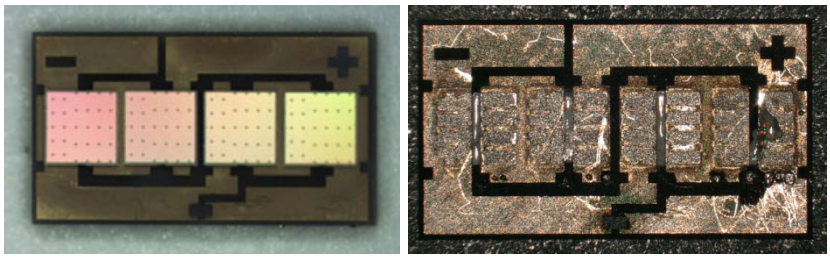
indicating a fourth opening providing a first electrode pad region where electrical current is provided to the LED.



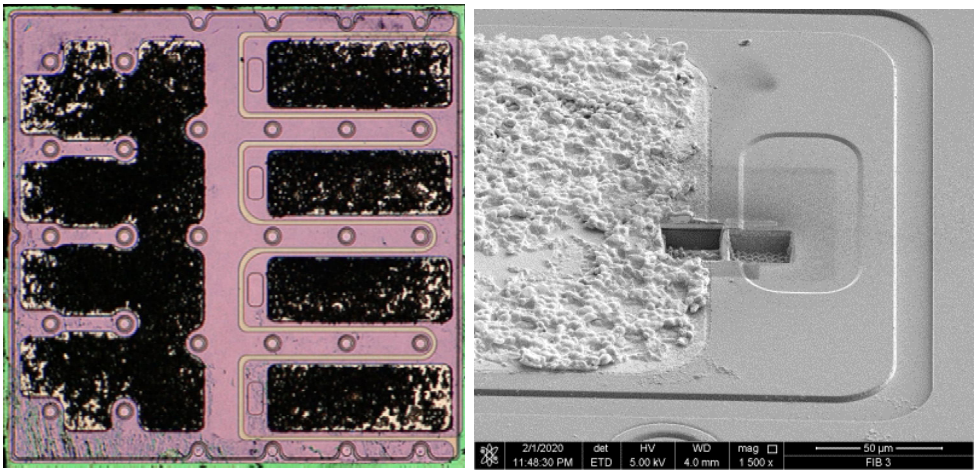
72. The SEM image below (left) once again shows an enlarged view of an area on the bottom surface of the chip where the second opening part is located. Extending from the middle of the SEM image below (right) to the right side of the image is another segment of the upper insulating layer. Here again, the absence of the upper insulating layer on the left side of the image indicates the region where solder is provided. The solder indicates a fifth opening part, which provides a second electrode pad region. In the image, the upper insulating layer forms a fifth opening part coincident with the area covered by solder. The area of the fifth opening part provides a second electrode pad region. In addition, the diffusion preventing layer is provided within the fifth opening exposed from the upper insulating layer.



73. The image below (left) once again shows the LED package of the LUMEN 9006HLC-G10. As shown in the image, the package comprises a plurality of LED chips adhering to a printed circuit board. The image below (right) shows the printed circuit board with the LED chips removed. As seen in the image, there is a first pad and second pad that would be situated between the printed circuit board and the LED chips when the LED chips are attached.



74. The image below (left) shows the bottom surface of an LED chip of the LUMEN 9006HLC-G10. The image below (right) shows an enlarged view of the portion of the bottom surface of the chip. As seen in the image, there is a soldering paste that adheres to the first electrode pad and second electrode pad.



75. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

76. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

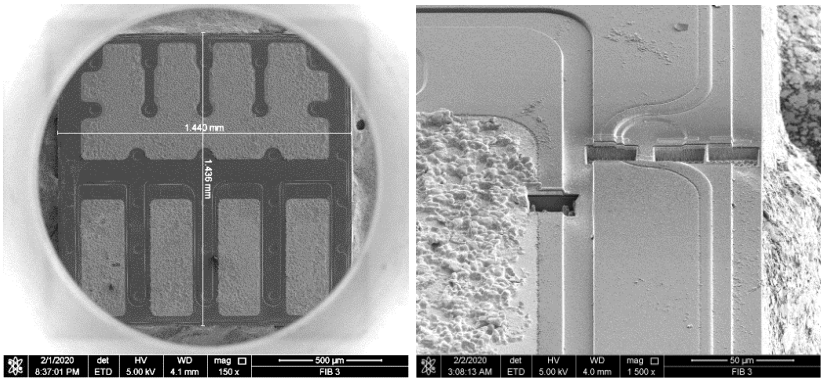
COUNT V

INFRINGEMENT OF THE '401 PATENT

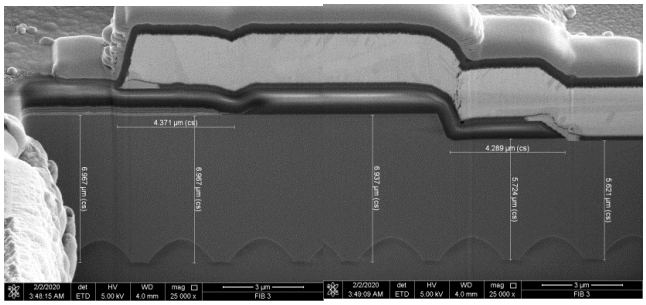
EXAMPLE CLAIM 1

77. CARiD has infringed and continues to infringe one or more claims of the '401 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

78. The SEM image below (left) shows the bottom surface an LED chip of the LUMEN 9006HLC-G10. The SEM image below (right) shows an enlarged view of a portion of the bottom surface of the LED chip. In the image, a plurality of holes have been milled into the LED chip using a focused ion beam.

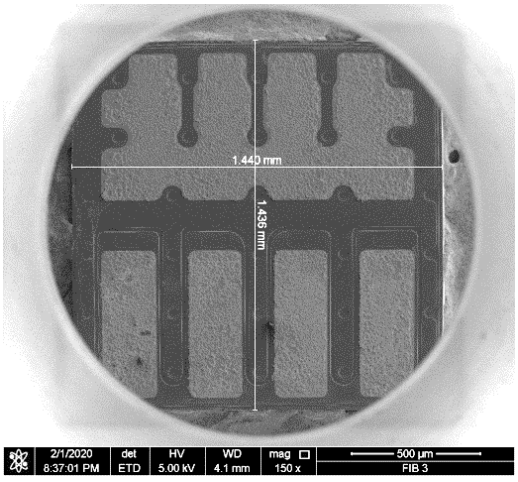


79. The SEM image below shows a cross-section created from scanning electron microscope images of the milled hole on the left side of the circular contact to the first semiconductor layer (n-type).

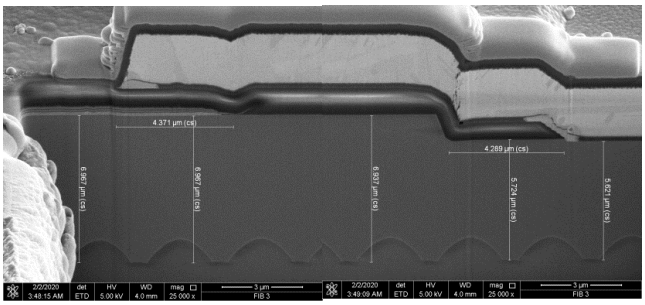


80. The center of the image above also shows a portion of the edge of a mesa structure, which includes, from bottom to top, a first semiconductor layer (n-type), an active layer formed over the first semiconductor layer, and a second semiconductor layer (p-type) formed over the active layer. The mesa structure has an edge to the right of the center of the image, which comprises an outer side wall of the stacked structure. The image above also shows a thick light-colored first conductive layer that is formed over the stacked structure to cover the outer side wall. Further, a first insulating layer is situated between the stacked structure and the first conductive layer, preventing the first conductive layer contacting the outer side wall.

81. As seen in the image below, there are two types of pads. Four p-type pads are provided on the lower portion of the image and a single n-type pad is provided on the upper portion of the image. Both types of pads are formed above the stacked structure.



82. The first conductive layer is electrically connected to the n-type pad. The far right side of the image below shows the first conductive layer in ohmic contact with the underlying first semiconductor (n-type) layer. The location of contact between the first conductive layer and the first semiconductor layer occurs outside of the side wall of the stacked structure shown in the center of the image below.



83. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

84. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

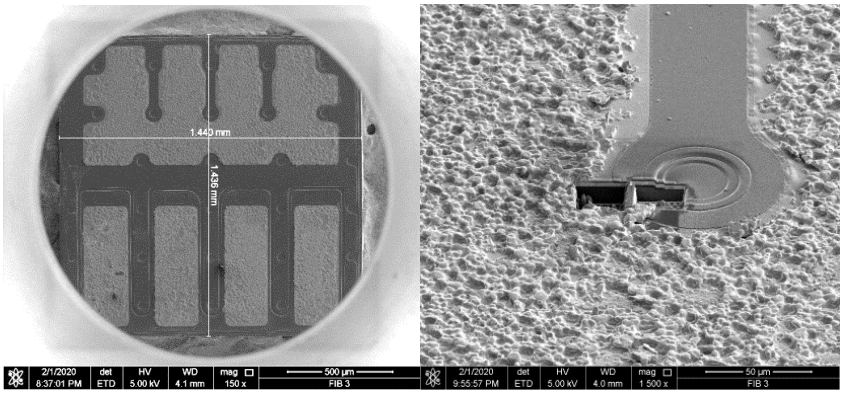
COUNT VI

INFRINGEMENT OF THE '469 PATENT

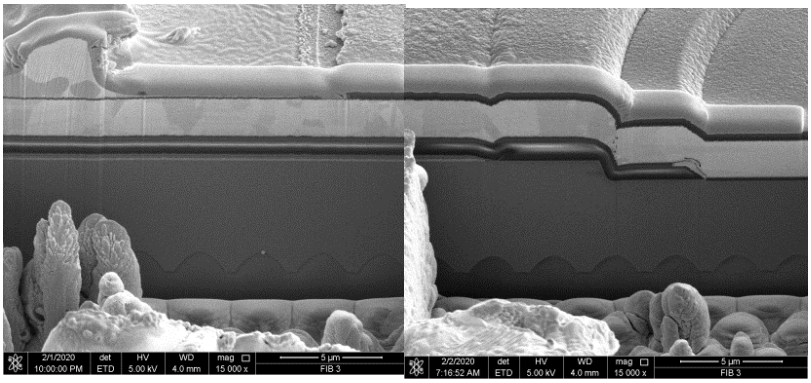
EXAMPLE CLAIM 14

85. CARiD has infringed and continues to infringe one or more claims of the '469 Patent, including but not limited to exemplary claim 14, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

86. The SEM image below (left) shows the bottom surface an LED chip of the LUMEN 9006HLC-G10. The SEM image below (right) shows an enlarged view of a portion of the bottom surface of the LED chip. In the image, two holes have been milled into the LED chip using a focused ion beam.

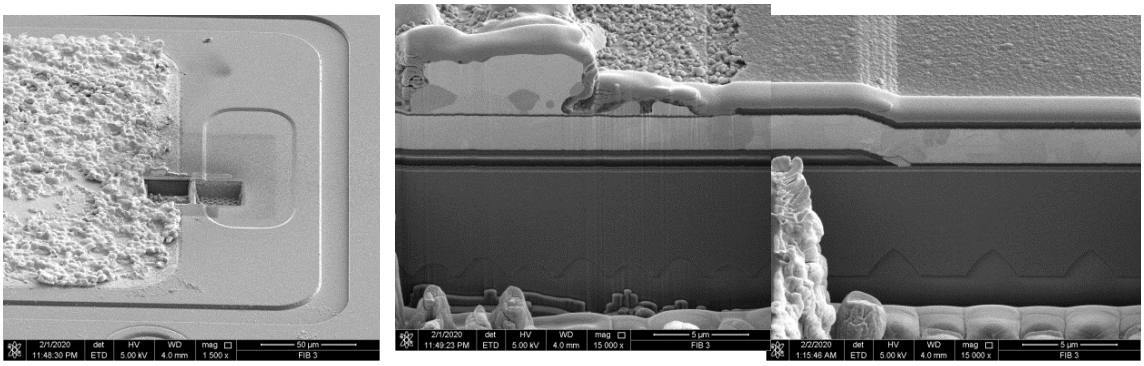


87. The SEM image below shows a cross-section created from scanning electron microscope images of the milled holes.

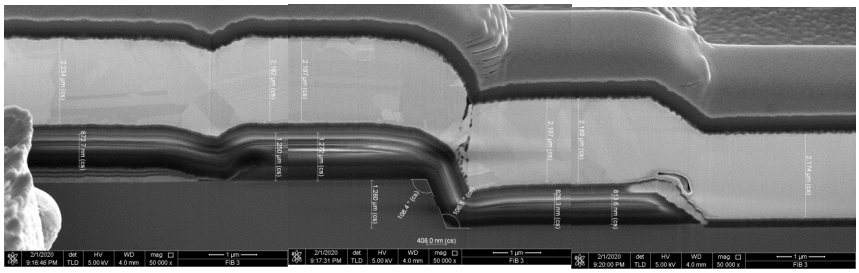


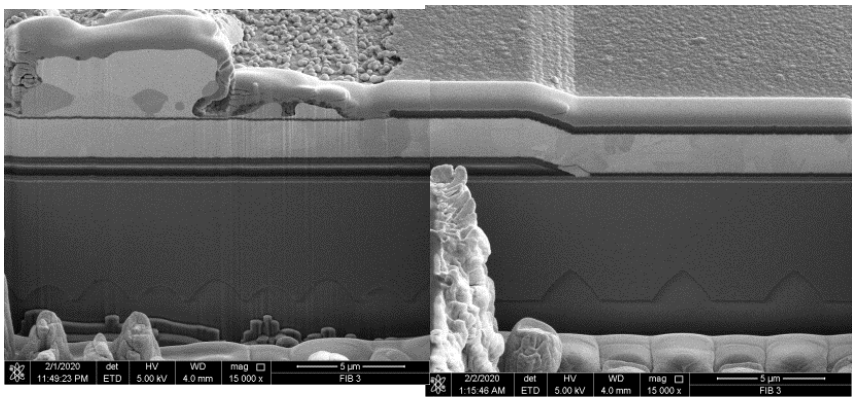
88. In the image above, a lighter-colored first conductive layer is shown extending from the left side of the image to the right. On the left side of the image, the first conductive layer is provided over a mesa structure including a first semiconductor (n-type) layer, an active layer disposed on a portion of the first semiconductor layer, and a second semiconductor (p-type) layer disposed on the active layer. On the far right side of the image above, the first conductive layer is shown disposed on the first semiconductor (n-type) layer.

89. The SEM images below show a different portion of the LED. Here again, the image below left shows an SEM indicating that a pair of holes have been milled into the surface of the LED. The SEM image below right is a cross-sectional view of the holes. The thick bright layer in the image below right indicates a second conductive layer disposed on the top of the second semiconductor (p-type) layer.

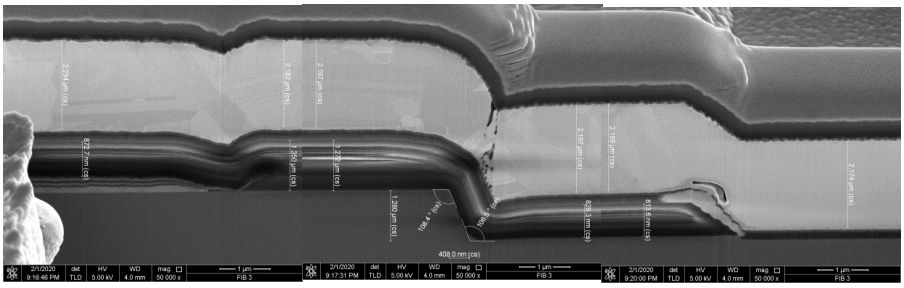


90. The images below reproduce again the SEMs of portions of the first conductive layer (top) and second conductive layer (bottom). In both images, an SiO_2 insulating layer is shown on the left side of the image separating the first and second conductive layers from the underlying semiconductor layers.





91. Focusing more specifically on the portion of the SiO_2 insulating layer under the first conductive layer in the image below, it can be seen that insulating layer has regions of differing thickness. Those regions include a first region on the mesa structure where the thickness varies, and therefore has different thicknesses. Those regions also include a second region having a substantially constant thickness. The first region includes a first portion near the center of the image that is adjacent to the edge of mesa, which is an end of the second semiconductor layer. The first portion has a first thickness. The first region also includes a second portion toward the left side of the image closer to the center of the second semiconductor layer having a second thickness, and a third portion between them with a gradually varying thickness.



92. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

93. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

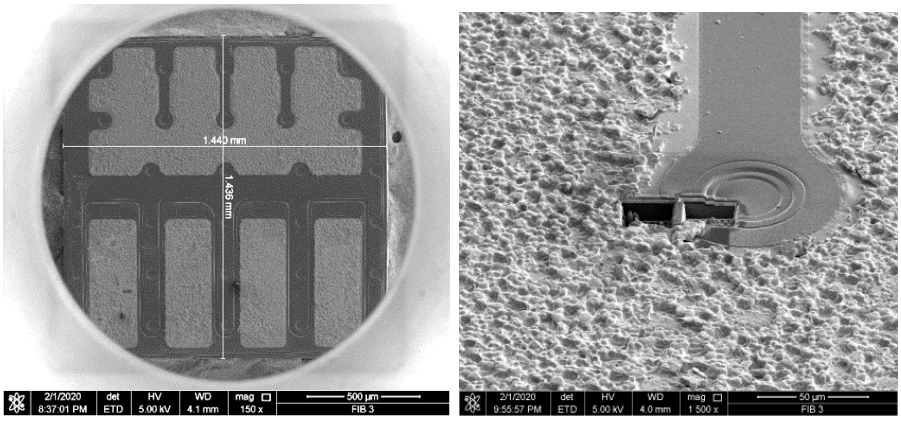
COUNT VII

INFRINGEMENT OF THE '409 PATENT

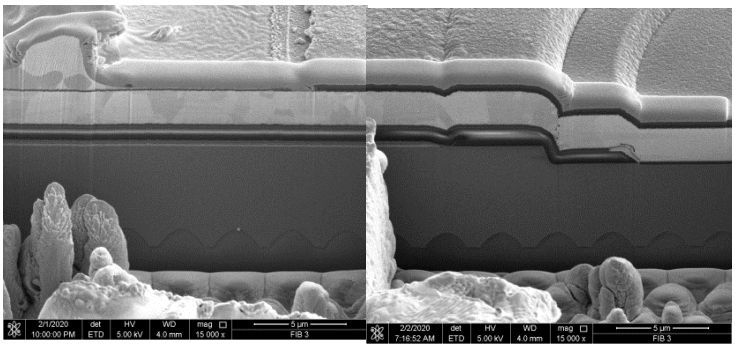
EXAMPLE CLAIM 1

94. CARiD has infringed and continues to infringe one or more claims of the '409 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

95. The SEM image below (left) shows the bottom surface an LED chip of the LUMEN 9006HLC-G10. The SEM images below (right) shows an enlarged view of a portion of the bottom surface of the LED chip. In the image, holes have been milled into the LED chip using a focused ion beam.



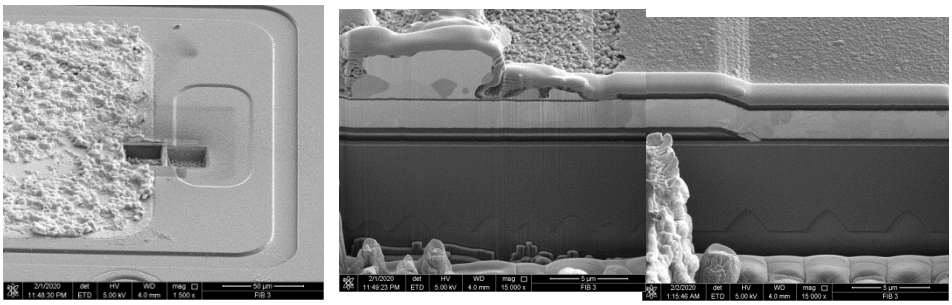
96. The SEM image below shows cross-sections created from scanning electron microscope images of the milled holes in the right image above. The left side of the image below shows a portion of a mesa that includes an active layer and a second semiconductor (p-type) layer. Near the right side of that image an edge of the mesa is shown.



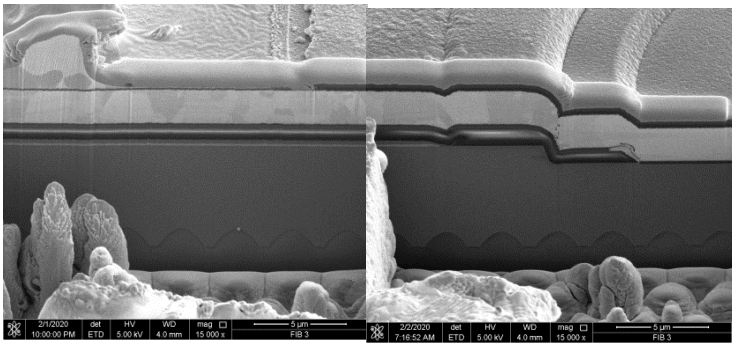
97. The image above also shows two contact layers. The first contact appears as a thick lightly colored layer that extends across the entire image. The first contact layer is shown disposed on the first type (n-type) semiconductor layer at the far right side of the image. The second contact layer appears as a thin lightly colored layer that extends across a portion of the top surface of the mesa. The second contact layer is disposed on the second type (p-type) semiconductor layer.

98. The image above also show a first insulation layer (SiO_2) that cover the second contact layer. At the edge of the mesa the first insulation layer extends over a sidewall of the active layer, and the second semiconductor (p-type) layer. The first insulating layer also contacts the bottom of the first contact layer. At the far right side of the image the first insulating layer has an opening that exposes the first semiconductor (n-type) layer.

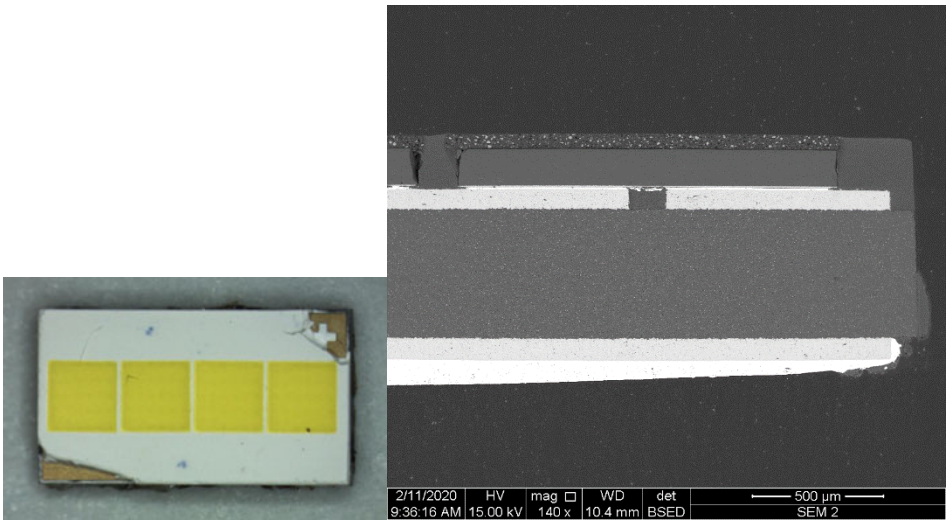
99. Two additional SEM images are reproduced below. The SEM image below left shows a different portion of the bottom surface of the LED with a pair of milled holes. The SEM image below right shows the inner surface of those milled holes to represent a cross section of that portion of the LED. The image below right again shows the second contact layer extending over the top of the mesa structure. The image also shows a portion of the first insulation that extends over the second contact layer. As shown on the far right side of the image below, the insulating layer has a second opening that exposes a portion of the second contact layer.



100. The SEM of the cross-section near the n-type contact is again reproduced below. On the right side of the image above the first contact layer a second (SiO_2) insulation layer is shown extending to the right edge of the image. The second insulation is disposed on a portion of the first insulation layer.



101. The image below (left) shows the LED package of the LUMEN 9006HLC-G10, which comprises a plurality of LED chips. The SEM image below (right) shows a cross-section through the package and one of its LEDs. The SEM image shows a pair of bumps both disposed on the same side (bottom) of the semiconductor stack. The bumps provide electrical connection to the underlying leads of the package. The bumps also respectively connect to the first contact layer and the second contact layer discussed above. The SEM also shows a third insulation layer that is disposed around the LED and on the side surfaces of the bumps.



102. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

103. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

COUNT VIII

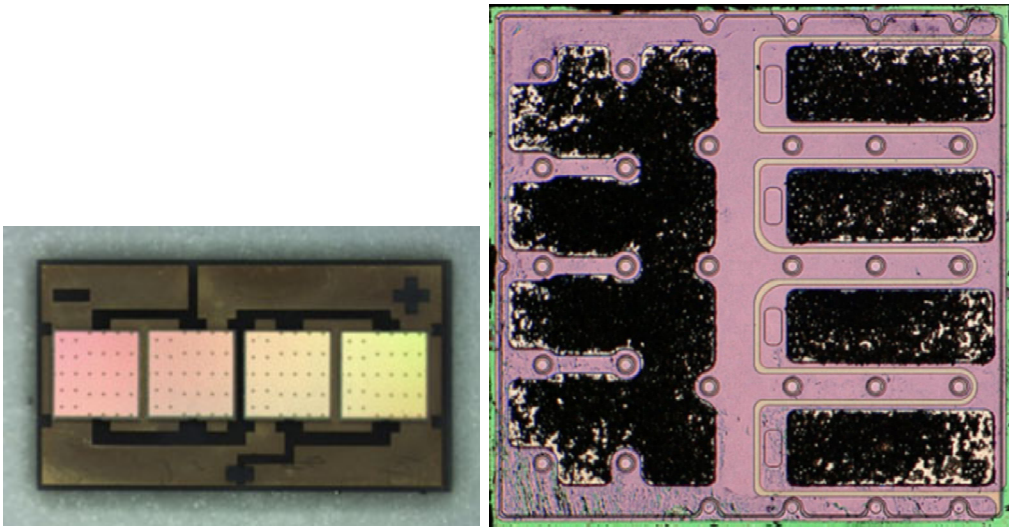
INFRINGEMENT OF THE '892 PATENT

EXAMPLE CLAIM 1

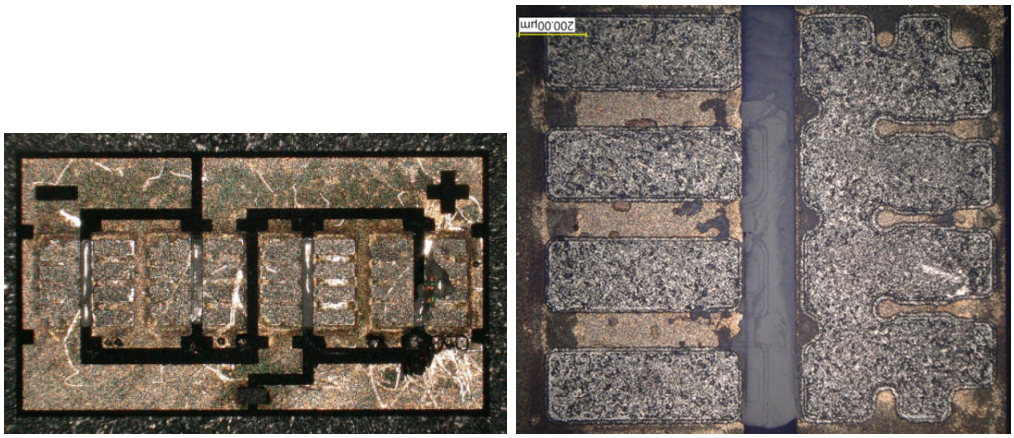
104. CARiD has infringed and continues to infringe one or more claims of the '892 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

105. The image below (left) shows the LED package of the LUMEN 9006HLC-G10. As shown in the image, the package comprises a plurality of LED chips adhering to a printed

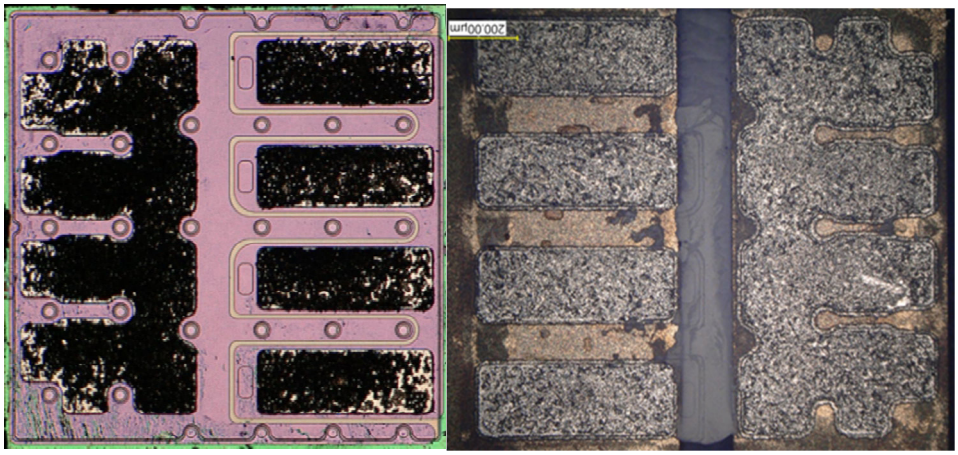
circuit board. The image below (right) shows the bottom surface of an LED chip of the LUMEN 9006HLC-G10. In the image, there are a plurality of electrode surfaces as shown by the darker regions some of the solder used to mount the LED remains. These electrode surfaces are arranged in a first direction, left to right, and a second direction, bottom to top. As shown in the image below (left), the chips are mounted on the circuit board of the package with the electrode surfaces oriented so they come into contact with the mounting surfaces on the circuit board.



106. The image below (left) shows the printed circuit board with the LEDs removed. The image below (right) shows an enlarged view of part of this circuit board where solder remains after removal of an LED. As shown in the image below (right), there are a plurality of pads upon which portions of the mounting solder remain.



107. The figures below align the device pads with the pads on the mounting substrate. As the figures show, the larger negative pad on the circuit board has a first width portion and a second width portion in the second (vertical) direction. And the negative electrode surface on the device has a third width portion in the second (vertical) direction. The second width portion is larger than the third, and the third width portion is larger than the first.



108. The images also show that the distance between the pads on the mounting substrate in the first (horizontal) direction is shorter than the distance between the electrode surfaces on the device in the first (horizontal) direction.

109. The alignment between the electrode surfaces on the device (above left) and the pads on the mounting substrate (above right) is shown in the correspondence between the outlines of the respective structures. In addition, the black material in the image above left and the grey material in the image above right both indicate the presence of solder, which was used as a conductive bonding agent.

110. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

111. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

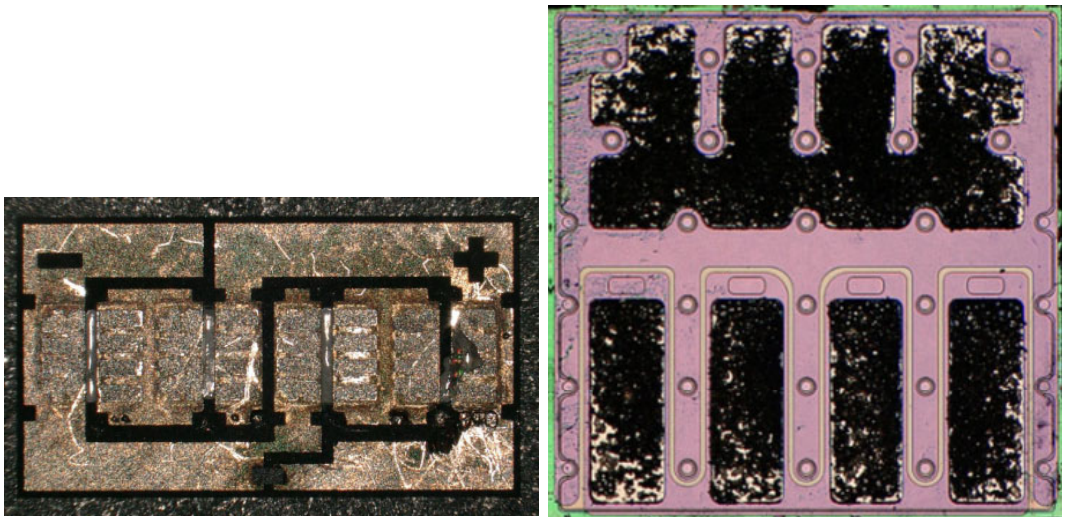
COUNT IX

INFRINGEMENT OF THE '367 PATENT

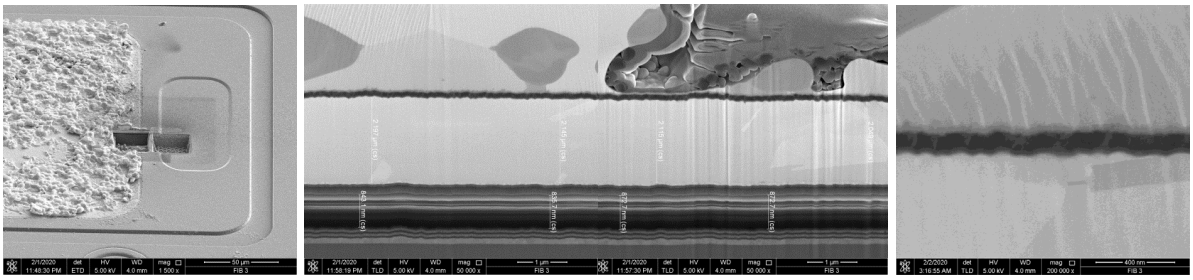
EXAMPLE CLAIM 1

112. CARiD has infringed and continues to infringe one or more claims of the '367 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 9006HLC-G10 fog light within the United States or importing the LUMEN 9006HLC-G10 fog light into the United States.

113. The optical image below (left) shows the printed circuit board with the LEDs removed. There is a mounting substrate in the center. The image below (right) shows the bottom surface of one of the plurality of LED chips mounted to the circuit board. As seen in the image, there is a first bonding pad, which is configured to be soldered to the mounting substrate. A solder ball contactable regions are depicted by the dark areas on the bottom half. A first bonding pad comprising two elongate opposed regions is disposed on one of the solder ball contactable regions. The non-conductive regions are shown between the solder ball contactable regions. Since the elongate opposed regions are disposed on the solder ball contactable regions, the non-conductive regions are also disposed between the at least two elongate, opposed regions.



114. The SEM image below (left) shows an enlarged view of a portion of the bottom surface of the chip with two holes milled using FIB. The image below (center) shows a cross sectional view created from the milled holes. The image below (right) is a zoomed in view of part of the cross-sectional view, specifically showing the first connection electrode. In the center image, the first electrode on the bottom is connected to the first bonding pad on top by the first connection electrode. On the bottom, there is a first conductive type semiconductor layer connected to the first electrode.



115. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

116. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

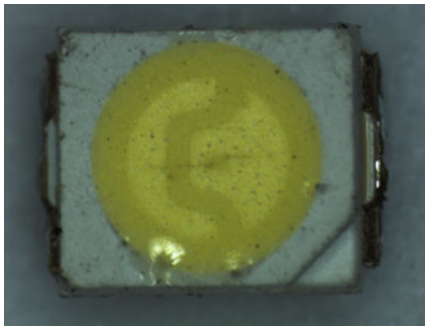
COUNT X

INFRINGEMENT OF THE '207 PATENT

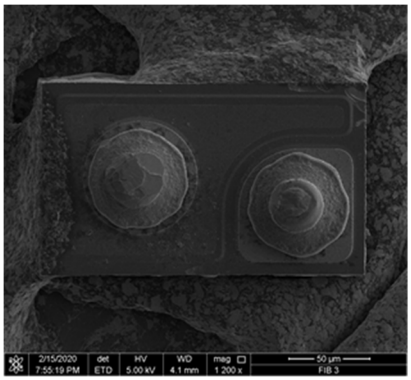
EXAMPLE CLAIM 7

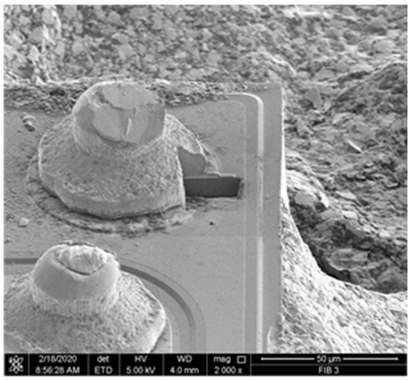
117. CARiD has infringed and continues to infringe one or more claims of the '207 Patent, including but not limited to exemplary claim 7, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 86-1001002 daytime running light within the United States or importing the LUMEN 86-1001002 daytime running light into the United States.

118. The LUMEN 86-1001002 daytime running light includes a plurality of LED packages, each of which includes a light emitting diode chip. The image of an LED package from an LUMEN 86-1001002 daytime running light is reproduced below. The image below shows the LED chip within package.

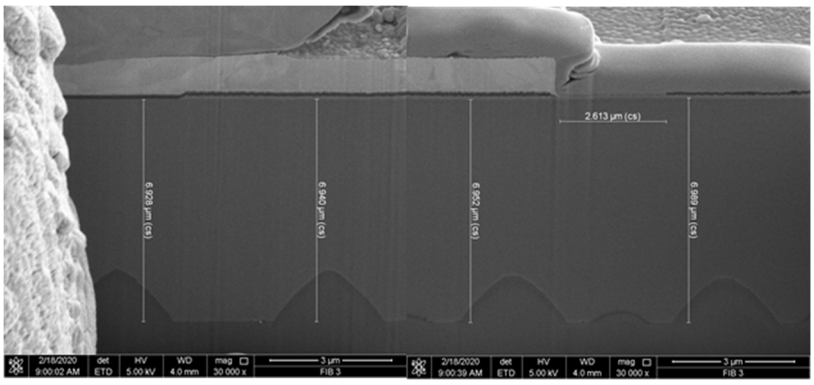


119. Below are two Scanning Electron Microscope images of the LED chip. The image to the left shows the top image of the LED chip, and the image below right shows the area surrounding the p-electrode of the LED chip. The dark space near the p-electrode indicates a hole created using a focused ion beam.





120. The below composite image show the cross-section of the hole created by the focused ion beam. Focusing in on the central part of the image, the cross-section shows from bottom to top (in relevant part) a substrate, an n-type semiconductor layer, an active layer, a p-type semiconductor layer, a transparent electrode layer and the p-electrode pad, which includes a thin layer of aluminum on its bottom surface. The transparent electrode layer is comprised of indium tin oxide, which appears as a relatively thin lightly colored layer on the top surface of the p-type semiconductor layer.



121. Focusing on the left side of the image above, there is shown from bottom to top a substrate, an n-type semiconductor layer, an active layer, a p-type semiconductor layer, and the p-electrode pad, which includes a thin layer of aluminum on its bottom surface. More specifically, in the leftmost region the thin layer of aluminum contacts the underlying p-type semiconductor rather than the transparent electrode layer. That area of contact indicates an opening in the

transparent electrode layer, where the contact between the aluminum and p-type semiconductor layer, comprises a current blocking portion.

122. With respect the central region of the image above, the electrode pad is arranged on an upper surface of the transparent electrode layer outside of the opening.

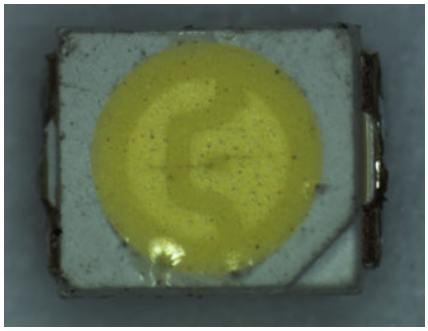
123. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

124. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

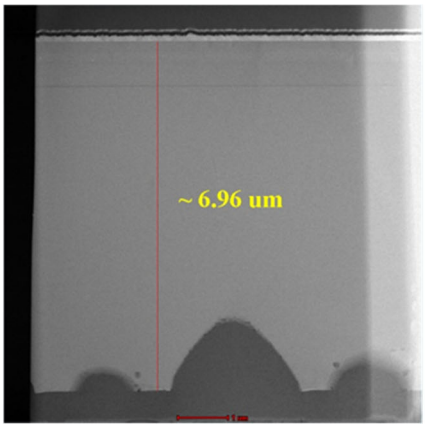
COUNT XI
INFRINGEMENT OF THE '731 PATENT
EXAMPLE CLAIM 1

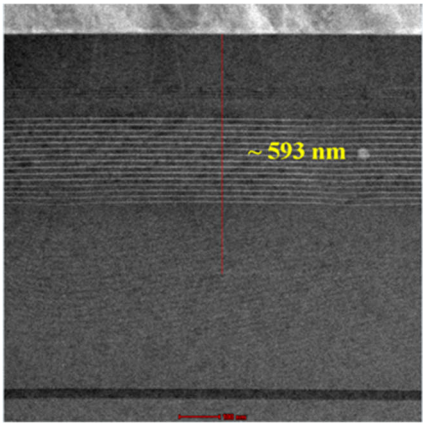
125. Upon information and belief, CARiD has infringed and continues to infringe at least exemplary claim 1 of the '731 Patent pursuant to 35 U.S.C. § 271(g) at least by without authority importing into the United States or offering to sell, selling, and/or using within the United States the LUMEN 86-1001002 daytime running light, which upon information and belief are made by a process that infringes that claim and are not materially changed by subsequent processes and do not become a trivial and nonessential component of another product.

126. The LUMEN 86-1001002 daytime running light includes a plurality of LED packages, each of which includes a light emitting diode chip. The image of an LED package from an LUMEN 86-1001002 daytime running light is reproduced below. The image below shows the LED chip within the package.

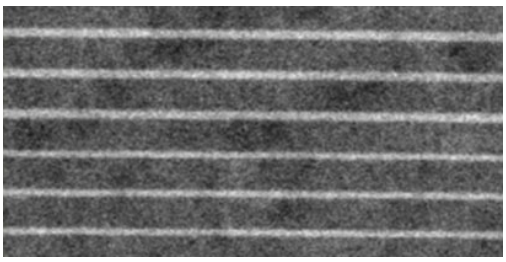


127. Below are two Transmission Electron Microscope images of the epi structure of the LED chip. The image to the left shows the entire epi-structure above a patterned sapphire substrate. The image below right enlarges the region of the epi-structure around the multi-quantum well active region.





128. The Transmission Electron Microscope image below further enlarges the multi-quantum well active region, which comprises a plurality of quantum dot layers separated by a plurality of barrier layers. The plurality of quantum dot layers appear as relatively thin and bright layers separated by relatively thick and dark barrier layers.



129. In view of the shape of the individual quantum dot layers, and upon information and belief regarding the process used to manufacture the LED chip, the manufacturing process included growth interruption after each layer of coherent quantum dots had been overgrown with a layer of semiconductor material at least thick enough to completely cover all the quantum dots.

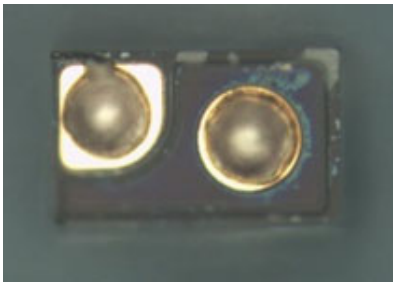
130. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

131. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

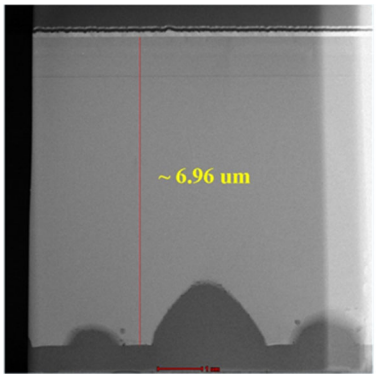
COUNT XII
INFRINGEMENT OF THE '868 PATENT
EXAMPLE CLAIMS 1

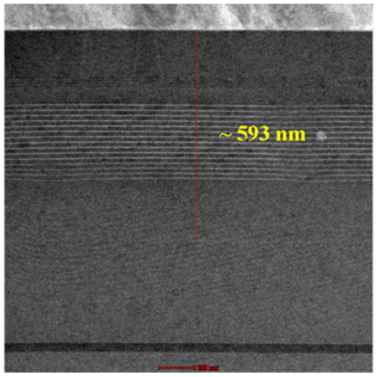
132. CARiD has infringed and continues to infringe one or more claims of the '868 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the LUMEN 86-1001002 daytime running light within the United States or importing the LUMEN 86-1001002 daytime running light into the United States.

133. The LUMEN 86-1001002 daytime running light includes a semiconductor light emitting element. A microscope image of an example light emitting element is reproduced below.

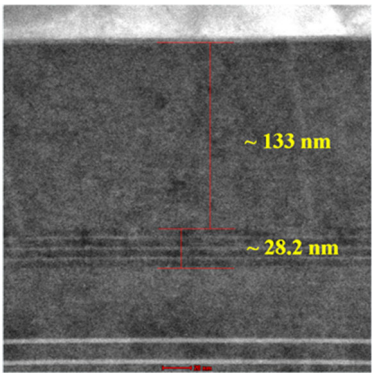


134. Two Transmission Electron Microscope images of the light emitting element are reproduced below. The image below left shows the full epi-structure above a patterned sapphire substrate. The image below right indicates a plurality of layers including from bottom to top (in relevant part) an n-type semiconductor layer, a light emitting unit comprised of a multi-quantum well, and a p-type semiconductor layer. The light emitting unit includes well layers comprised of indium gallium nitride.





135. The image below right focusses in on the p-type semiconductor layer. As the image shows, a number of layers as described above located below the p-type semiconductor layer, with the relative brightness of each layer correlating with the dopant concentration. From bottom to top, the layers include a first layer, a second layer, and a third layer, each of which has different levels of the Magnesium doping, the first layer with relatively low Magnesium doping, the second layer with relatively high Magnesium doping, and the third layer with intermediate Magnesium doping



136. CARiD's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

137. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs demand judgment in their favor and against CARiD as follows:

A. A declaration that CARiD has infringed the '105 Patent, '851 Patent, '543 Patent, '240 Patent, '401 Patent, '469 Patent, '409 Patent, '892 Patent, '367 Patent, '207 Patent, '731 Patent, and '868 Patent under 35 U.S.C. § 271, and a final judgment incorporating the same;

B. A permanent injunction, enjoining CARiD and its officers, agents, servants, employees, representatives, successors, and assigns, and all others acting in concert or participation with them from continued infringement under 35 U.S.C. § 271 of the '105 Patent, '851 Patent, '543 Patent, '240 Patent, '401 Patent, '469 Patent, '409 Patent, '892 Patent, '367 Patent, '207 Patent, '731 Patent, and '868 Patent;

C. An award of damages adequate to compensate Plaintiffs for CARiD's infringement the '105 Patent, '851 Patent, '543 Patent, '240 Patent, '401 Patent, '469 Patent, '409

Patent, '892 Patent, '367 Patent, '207 Patent, '731 Patent, and '868 Patent, together with prejudgment and post-judgment interest and costs pursuant to 35 U.S.C. § 284;

D. An accounting of all infringing sales and other infringing acts by CARiD, and an order compelling an accounting for infringing acts not presented at trial and an award by the Court of additional damages for such acts; and

E. Any other relief to which Plaintiffs are entitled or that the Court seems just and proper.

JURY DEMAND

Plaintiffs demand trial by jury.

DATED: May 15, 2020

HOLLAND & KNIGHT LLP

/s/ Charles A. Weiss

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CERTIFICATION PURSUANT TO LOCAL CIVIL RULE 11.2

Pursuant to Local Civil Rule 11.2, I hereby certify under penalty of perjury that, to the best of my knowledge, the matter in controversy is not the subject of any other action pending in any other court or of any pending arbitration or administration proceeding.

Dated: May 15, 2020

/s/ Charles A. Weiss
Charles A. Weiss